



Introduction

The 2015 benchmark stock assessment for tautog is the most comprehensive to date. It differs from previous assessments conducted at a single coastwide level by providing multiple alternatives for how tautog can be assessed and managed regionally. The assessment was peer-reviewed by an independent panel of scientific experts through the Atlantic States Marine Fisheries Commission's integrated external peer review process, which includes input from an independent peer reviewer throughout the assessment process.

Management Overview

Currently, tautog (*Tautoga onitis*) is managed as a single stock from Massachusetts through North Carolina. An increase in fishing pressure in the mid-1980s through early 1990s, and a growing perception of the species' vulnerability to overfishing, stimulated the need for a coastwide fishery management plan. Accordingly, the Interstate Fishery Management Plan for Tautog was implemented in 1996.

In April 2011, Addendum VI to the FMP established a new fishing mortality (F) target of $F = M = 0.15$ on the basis that stock biomass had not responded to previous F levels. The new F_{TARGET} required states to take a 39% reduction in harvest. A regional assessment of Massachusetts and Rhode Island demonstrated a lower regional F, and these states were not required to implement tighter regulations. To achieve the required harvest reduction, all other states adopted higher minimum size limits (15-16 inches) in addition to other measures, such as possession limits, seasonal closures, and gear restrictions.

What Data Were Used?

The tautog assessment used both fishery-dependent and independent data as well as information about tautog biology and life history. Fishery-dependent data come from the commercial and recreational fisheries, while fishery-independent data are collected through scientific research and surveys.

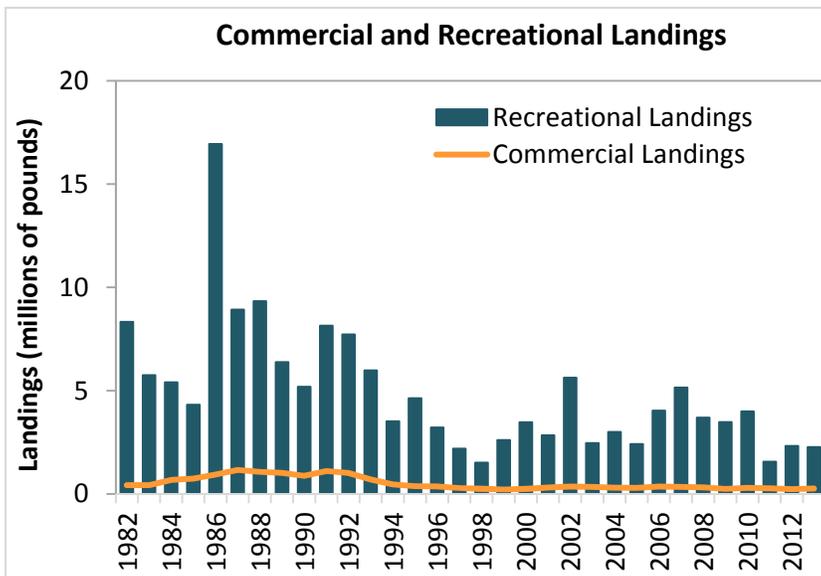
Life History

Tautog are a species of wrasse found on the Atlantic coast. Unlike most wrasse species, which inhabit tropical waters, tautog are most abundant from the southern Gulf of Maine (lower Massachusetts Bay and southern Cape Cod Bay) to Chesapeake Bay. Like their warm-water cousins, they are very structure-oriented and prefer to live on rock reefs. Tagging data suggest tautog may make some offshore migrations during colder weather, but they do not make extensive north-south migrations along the coast. In fact, some tautog have been recaptured multiple times on the same reef. Because of this, tautog was assessed as three separate, regional stocks: a Southern New England stock (Massachusetts, Rhode Island, and Connecticut), a New York-New Jersey (NY-NJ) stock, and a DelMarVa stock (Delaware, Maryland, and Virginia). The stock boundaries were determined by life history information and exploitation patterns.

Age and growth studies indicate tautog are slow-growing and long-lived. Fish as old as thirty years have been caught in Rhode Island, Connecticut, and Virginia, but most of the fish caught are four to eight years old. The largest record catch was twenty-eight pounds.

Commercial and Recreational Data

Total catch included estimates of recreational landings and discards from Marine Recreational Fishery Statistics Survey/Marine Recreational Information Program (MRFSS/MRIP) conducted by the NOAA Fisheries. Commercial landings were taken from the Atlantic Coastal Cooperative Statistics Program (ACCSP). Tautog are targeted by both commercial and recreational fisheries, but approximately 90% of the total harvest comes from the recreational fishery. Commercial harvest data for tautog are available from 1950 to present, while recreational harvest estimates are available for 1981 to present. Commercial records indicate low harvest levels during the 1950s through 1970s, and the same is assumed for the recreational harvest. As the popularity of the species increased and technological advancements made it easier to find tautog habitat, a directed fishery for tautog developed. Landings increased rapidly during the 1980s to approximately one million pounds in the late 1980s and early 1990s. Total landings have since declined substantially, to an average of 250,000 pounds coastwide in 2011-2013.



Tautog are not well-sampled by the MRFSS/MRIP program, resulting in higher PSEs (approximately 20-30% in recent years at the regional level) and large year-to-year swings in catch estimates. Similar to commercial landings, coastwide recreational harvest peaked in the late 1980s and early 1990s with a peak of 17 million pounds caught in 1986 (other years were in the 6 - 9 million pound range). Recreational landings have declined since then, averaging approximately 2 million pounds in 2011-2013. The proportion of fish released alive has increased over this time-period, from only 20% of fish caught in the early 1980s to

80% of tautog being released alive in 2011-2013. The assessment assumed that 2.5% of the tautog that are released alive by anglers die as a result of being caught.

Because collection of age data began at different times in each of the regions, the Southern New England (SNE) assessment starts in 1982, the NY-NJ assessment starts in 1989, and the DelMarVa assessment starts in 1990. All assessments use data through 2013, the most recent year of available catch and index data.

Indices of Abundance

Tautog are not easily sampled by standard trawl-based fishery-independent surveys, because it's hard to trawl over their preferred habitat of rocky reefs. The assessment investigated fishery-independent surveys from Massachusetts through Maryland, of which four adult and three young-of-year surveys and were deemed appropriate for use in the assessment. Adult surveys included the Massachusetts Division of Marine Fisheries Trawl Survey, the Rhode Island Trawl Survey, the Connecticut Long Island Sound Trawl Survey, and the New Jersey Trawl Survey. Young-of-year surveys included the Rhode Island Seine Survey, the New York Peconic Bay Trawl and Seine Surveys.

In addition, regional fishery-dependent indices of abundance (catch per unit effort, CPUE) were developed from the MRFSS/MRIP intercept data.

What Models Were Used?

Three different models were explored for assessing tautog. The preferred model was ASAP, a statistical catch-at-age model that is part of the NOAA Fisheries Toolbox. In addition, the Technical Committee developed two data-poor models, the Extended Depletion-Based Stock Reduction Analysis (XDBSRA) and a Bayesian State Space Surplus Production Model (BSSSPM). All three models incorporated annual harvest estimates and adult fishery-independent and -dependent biomass indices, while ASAP also incorporated available age structure, size at age, and juvenile abundance indices.

All three models produced similar trends in fishing mortality and biomass for the SNE and DelMarVa regions with robust results, although on different scales. ASAP and xDB-SRA models were consistent in the NY-NJ region, but the BSSPM produced unrealistic results. The three-region structure ASAP model was the preferred approach due to (1) the ability to incorporate available age information and uncertainty in the catch and survey data and (2) the good performance and stability even at small regional scales. The data poor methods provided corroborating evidence to the ASAP model.

To account for uncertainty in regional boundaries due to data gaps and considerations for consistent management, the assessment explored alternative regional groupings. Alternate configurations included a coastwide model, a two-region breakdown (Massachusetts – New York and New Jersey – North Carolina), and an alternate three-region breakdown (Massachusetts – Rhode Island, Connecticut – New Jersey, Delaware – North Carolina). Results of these regional configurations were also evaluated during the peer review process. The peer review panel approved the assessment-preferred three region definition and deemed it as a suitable option for management purposes, but noted that the data were not strong enough to unequivocally define the best regional definition. Managers may select an alternative regional definition as appropriate for consistent fishing regulations.

What is the Status of the Stock?

Biological Reference Points

The assessment proposed new reference points for all three regions. Maximum sustainable yield (MSY) based reference points were proposed for the SNE region due to the longer time-series of data. The spawning stock biomass (SSB) target is equal to SSB_{MSY} and the $SSB_{THRESHOLD}$ is equal to 75% of SSB_{MSY} . This resulted in an SSB_{TARGET} of 3,883 MT and an $SSB_{THRESHOLD}$ of 2,912 MT. The fishing mortality (F) target was defined as F_{MSY} (0.15), and the $F_{THRESHOLD}$ is 0.20. The threshold was calculated by finding the F that results in the $SSB_{THRESHOLD}$ under equilibrium conditions.

Tautog Stock Status and Proposed Biological Reference Points by Preferred Stock Regions

Stock Region	Stock Status	SSB Target	SSB Threshold	F Target	F Threshold
Southern New England	Overfished	3,883	2,912	0.15	0.20
	Experiencing Overfishing				
New York – New Jersey	Overfished	3,570	2,640	0.17	0.26
	Not Experiencing Overfishing				
DelMarVa	Overfished	2,090	1,580	0.16	0.24
	Not Experiencing Overfishing				

The assessment proposed spawning potential ratio (SPR) based reference points for NY-NJ and DelMarVa regions due to the shorter time-series of the data with F_{TARGET} equal to $F_{40\%SPR}$ and $F_{THRESHOLD}$ equal to $F_{30\%SPR}$. For NY-NJ, this resulted in F_{TARGET} equal to 0.17 and $F_{THRESHOLD}$ equal to 0.26. For DelMarVa, this resulted in F_{TARGET} equal to 0.16 and $F_{THRESHOLD}$ equal to 0.24. For NY-NJ the SSB_{TARGET} equals 3,570 MT, and the $SSB_{THRESHOLD}$ equals 2,460 MT. For DelMarVa, SSB_{TARGET} equals 2,090 MT and $SSB_{THRESHOLD}$ equals 1,580 MT.

Based on the recommended stock definition and reference points in the assessment, the proposed stock status for each of the regions is listed below. These stock status determinations are not finalized until they are approved by the management board.

Southern New England

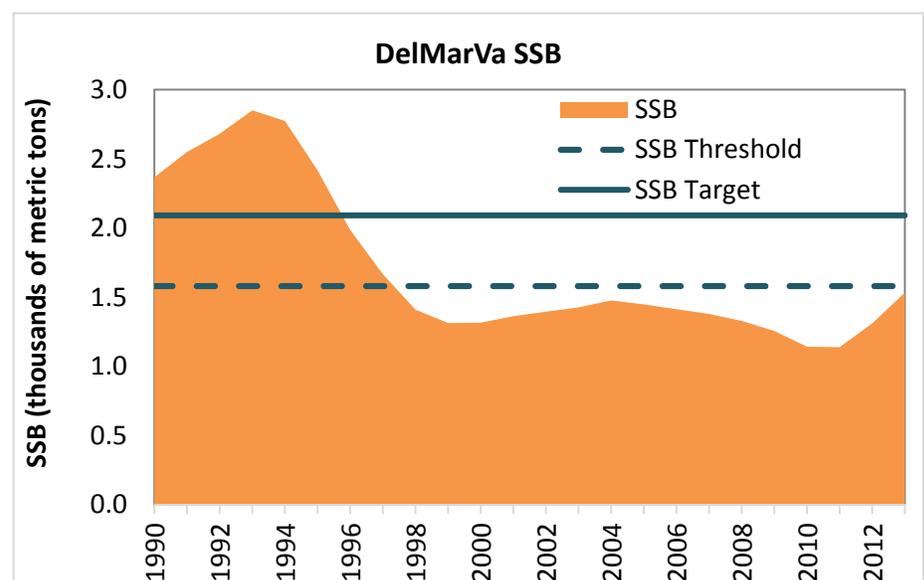
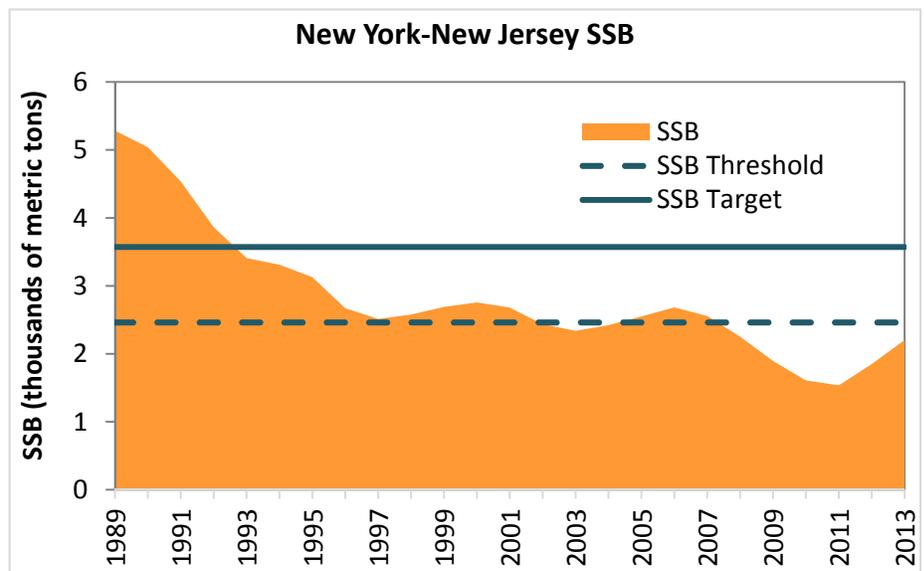
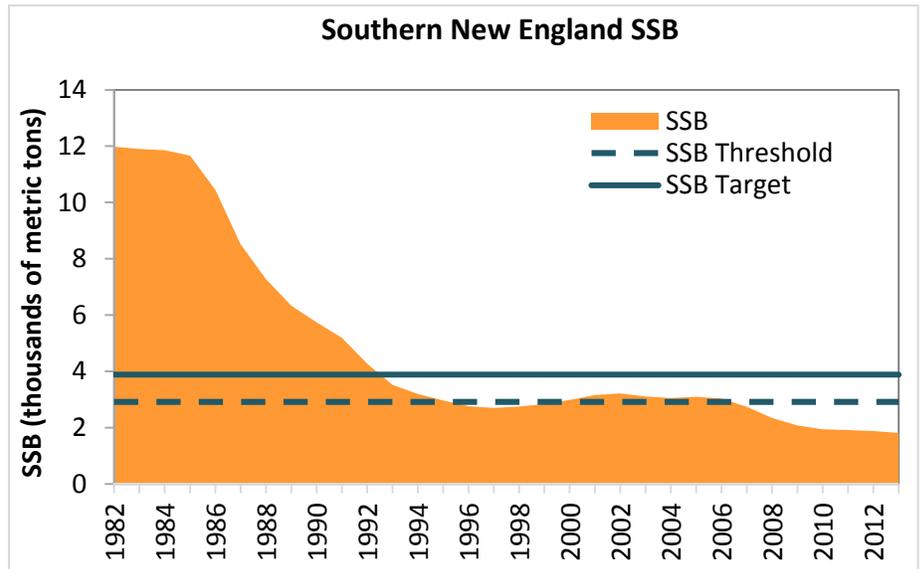
Tautog in SNE are overfished and experiencing overfishing relative to the assessment recommended reference points. In 2013, SSB was estimated at 1,814 MT, below the $SSB_{THRESHOLD}$, and the three-year average of F was estimated at 0.48, above the $F_{THRESHOLD}$.

New York-New Jersey

Tautog in the NY-NJ region are overfished, but not experiencing overfishing relative to the assessment recommended reference points. In 2013, SSB was estimated at 2,202 MT, below the $SSB_{THRESHOLD}$, but the three-year average of F was estimated at 0.24, below the $F_{THRESHOLD}$, although still above the F_{TARGET} .

DelMarVa

Tautog in the DelMarVa region are overfished, but not experiencing



overfishing relative to the assessment recommended reference points. In 2013, SSB was estimated at 1,532 MT, below the $SSB_{THRESHOLD}$, but the three-year average of F was estimated at 0.16, below the $F_{THRESHOLD}$ and equal to the F_{TARGET} .

Data and Research Needs

The Technical Committee compiled a list of prioritized research needs to improve understanding of tautog life history and stock dynamics as well as aid in development of future stock assessments. High priority needs included improved biological sampling of the catch for commercial and recreational fisheries, better sampling of the smallest and largest fish, improved characterization of the lengths of discarded or released fish, and development of a comprehensive fishery-independent survey that is more appropriate for a reef-oriented species, such as a pot or trap survey. In addition, the Technical Committee supports efforts to better define the stock structure of tautog through genetic studies and improved biological data collection.

What are the Next Steps for Management?

After reviewing the results of the stock assessment and peer review report, the Tautog Management Board accepted the 2015 benchmark stock assessment for management use. However, it expressed concern with the preferred stock definition that would split Long Island Sound into two regions with potentially different regulations. In the absence of conclusive biological evidence to define the regional boundaries, the Board will consider the management implications of regionalization and choose its preferred regions for future management. In addition, the Board tasked the Tautog Technical Committee to develop reference points that provide consistent metrics to determine stock status across regions. Results will be presented to the Board for its consideration at the Commission's Spring Meeting in May.

Whom Do I Contact For More Information?

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Glossary

Age class: all of the individuals in a stock that were spawned or hatched in the same year. This is also known as the year class or cohort.

Catch-at-age: the number of fish of each age that are removed in a year by fishing activity.

Maximum Sustainable Yield (MSY): The largest average catch that can be taken from a stock over time under existing environmental conditions without negatively impacting the reproductive capacity of the stock.

Mortality: The rate at which fish die, expressed either as an annual percentage or instantaneous rate (the portion of the stock dying within each small amount of time). Instantaneous rates are used in most stock assessment modeling equations. Fishery scientists estimate several different types of mortality to evaluate the status of fish stocks, and some mortality rates serve as biological reference points.

Fishing mortality (F): the instantaneous (not annual) rate at which fish are killed by fishing

Natural mortality (M): the instantaneous (not annual) rate at which fish die because of natural causes (predation, disease, starvation, etc.)

Overfished: A stock exploited to a level of abundance considered too low to ensure safe reproduction.

Overfishing: Harvesting from a stock at a rate greater than the stock's reproductive capacity to replace fish removed through harvest.

Statistical catch-at-age (SCAA) model: an age-structured stock assessment model that works forward in time to estimate population size and fishing mortality in each year. It assumes some the catch-at-age data have a known level of error.

Spawning potential ratio (SPR): Most commonly calculated as the ratio of spawning stock biomass per recruit (SSBR) of a fished stock divided by SSBR of an unfished stock. SPR represents the reproductive potential (SSB or egg production per recruit) of a fished stock compared to its unfished condition.

Spawning stock: The female portion of a fish stock that is mature.

Spawning stock biomass: The total weight of the mature females within a stock of fish; frequently used instead of total biomass as a better measure of the ability of a stock to replenish itself.

Young-of-the-year (YOY): An individual fish in its first year of life; for most species, YOY are juveniles.

References

ASMFC. 2015. Tautog Stock Assessment Report for Peer Review. Atlantic States Marine Fisheries Commission, Stock Assessment Report, 309 p.

ASMFC. 2009. Guide to Fisheries Science and Stock Assessments. Washington, DC.
<http://www.asmfc.org/publications/GuideToFisheriesScienceAndStockAssessments.pdf>